Cambridge Journal of Education
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/ccje20

Gender, parental education, and ability: their interacting roles in predicting GCSE success

Judith Glaesser [a] & Barry Cooper [a]
[a] School of Education Durham University , Leazes Road, Durham , DH1 1TA , UK
Published online: 20 Nov 2012.

Cambridge Journal of Education
Vol. 42, No. 4, December 2014, 463–480

Gender, parental education, and ability: their interacting roles in predicting GCSE success

Judith Glaesser* and Barry Cooper

School of Education Durham University, Leazes Road, Durham DH1 1TA, UK

(*Received 8 August 2011; final version received 7 February 2012*)

We investigate the relations between gender, parental education, ability, and educational achievement in Britain, focusing on the way in which gender and parental education interact with ability to contribute to a pupil's obtaining secondary school qualifications. This allows us to provide evidence relevant to claims concerning the effects of differences in the way in which working- and middle-class familial cultures interact with gender-specific behaviour in school. Given the configurational nature of the processes likely to be involved, we employ Ragin's Qualitative Comparative Analysis as our method. We find that, in both academically selective and non-selective schools, high ability is a quasi-sufficient condition for obtaining certain levels of qualification, but that at lower levels of ability, either being female or having highly educated parents (or both) have to be present, too. Boys without highly educated parents perform less well than girls from a similar background.

Keywords: gender; parental education; ability; GCSE; selective schools; Qualitative Comparative Analysis; Britain

This paper addresses the question of how gender and social background as indicated by parental education combine in predicting educational achievement. There is an extensive body of research on the links between social background[1] and gender in relation to educational outcomes, but it does not always take the relationship between these two factors into account in explaining these links. This relationship will be our focus here. To explore it, we use a method well-suited to exploring complex configurations of factors and their relationship to an outcome, Charles Ragin's Qualitative Comparative Analysis (QCA), which we explain briefly below.

The structure of the paper is as follows: in the introductory section, we discuss literature which is relevant to both of our factors, gender and parental education, and whether and how they interact to predict and produce educational outcomes. We then describe our data. This is followed by the results section, which also serves to introduce our method, QCA. We close with a discussion of our findings.

*Corresponding author. Email: Judith.Glaesser@durham.ac.uk

ISSN 0305-764X print/ISSN 1469-3577 online

http://dx.doi.org/10.1080/0305764X.2012.733346
http://www.tandfonline.com

Gender and educational outcomes

There is considerable evidence that girls perform better at school than boys in most industrialised societies (e.g. Buchmann, DiPrete, & McDaniel, 2008; Ofsted, 2003). They get higher marks on tests and exams early in their educational careers, and teachers tend to judge them as being more able. This is sometimes debated as though it were a recent phenomenon, but, as Cohen (1998) points out in her historical overview of boys' and girls' scholastic achievements, this is by no means the case and accounts of girls' outperforming boys go back a long time (see also Buchmann et al., 2008; Hammersley, 2001). Indeed, girls did better than boys in the eleven plus examination whose results were used to allocate grammar school places in England and Wales until the introduction of comprehensive schools, but boys and girls were awarded grammar school places in similar proportions on the grounds that boys develop later and it would therefore be unfair to base boys' future school careers on their performance at the age of 11 (Epstein, Elwood, Hey, & Maw, 1998). However, in the past, this did not lead to girls' achieving higher qualifications at the end of their school careers; they still lagged behind boys. This has now changed. It is well documented that girls have caught up with boys in terms of highest qualification obtained and, in many cases, overtaken them (Buchmann & DiPrete, 2006; Buchmann et al., 2008). In England, this now applies to all GCSE (General Certificate of Secondary Education) subjects. GCSE exams are usually taken by 16-year-olds. Boys used to gain more qualifications in mathematics and sciences than girls while girls did better in English and similar subjects. Girls have since caught up in mathematics, and have maintained their advantage in languages, relative to boys (Hammersley, 2001; Ofsted 2003). Seeking to explain girls' higher attainment, Murphy and Elwood (1998) discuss behaviour differences which influence how boys and girls learn. Epstein et al. (1998) cite the fact that young children's environment is dominated by women and an increased use of standards and targets as reasons given for boys' relative underperformance. None of these explanations take social background into account. Given the well-documented link between social class of origin and educational attainment, it is worth exploring possible interrelations between class, gender, and achievement. First of all, we should very briefly summarise some relevant points from the literature on class.

Social class and educational outcomes

While, over time, in many countries, social class inequality in education has diminished, though to varying degrees, parental social class remains linked to educational outcomes (e.g. Breen, Luijkx, Müller, & Pollak, 2010; Erikson & Jonsson, 1996; Müller & Haun, 1994; Shavit & Blossfeld, 1993). Various explanations for this have been offered, falling broadly into two categories. One type of explanation employs Bourdieu's concepts of habitus and cultural capital (Bourdieu, 1986; Bourdieu & Passeron, 1977), the other uses Boudon's model of primary and secondary effects (Boudon, 1974) and rational choice type explanations[2] (e.g. Becker, 2000; Boudon, 1974; Breen & Goldthorpe, 1997). Primary effects, according to Boudon, refer to class differences in academic achievement early in a child's career. Then, even given similar levels of initial achievement, secondary effects, resulting from differences in decision-making behaviour between children from different social class origins, lead students to choose educational pathways differing in prestige and levels of possible qualification. Our concern here though is with the interaction of gender and class, and it is to this we now turn.

Social class, gender, and educational outcomes

Breen et al. (2010), focusing on gender and class, point out that primary effects are unlikely to be responsible for girls' potentially being disadvantaged in education, especially given that girls actually perform better in school than boys. With regard to secondary effects, they argue that these will have been contributing to girls' lower levels of attainment in the past, but given the more recent decline in gender-based differences in the expected benefits of qualifications, secondary effects are likely to have diminished, too. This explanation is in line with evidence of a marked increase in women's educational participation across industrialised societies. In their analysis of current educational data from seven countries, Breen et al. (2010) did not find systematic gender differences within social classes, although they did find that the disadvantage of daughters of the self-employed is slightly smaller than that of sons.

Analysing differences in classroom performance rather than eventual level of highest qualification, some authors do find that there is an interaction between class and gender. While there is no clear difference between the performance of middle-class boys and girls, working-class girls tend to perform better than working-class boys. This finding is cited as one, if not the main, reason for the overall gender gap (Entwisle, Alexander, & Olson, 2007). One explanation offered for this class/gender interaction is that girls' behaviour is generally more compatible with that expected in the school (for the literature, see Buchmann et al., 2008). Also, middle-class culture and values more closely match school culture, and therefore boys who are socialised in a middle-class home will be able to overcome the potential disadvantage due to their gender, while working-class boys will not (Entwisle et al., 2007). Care should be taken, however, not to ascribe an anti-school culture to the working class as a whole, given the long-standing working-class tradition of valuing learning and education (Abraham, 2008).

Notwithstanding the gender differences in performance and attainment described so far, we should note that within-gender differences, most notably social class differences, remain greater than between-gender differences (Breen et al., 2010; Epstein et al., 1998; Francis & Skelton, 2005; Lucey, 2001; Müller, 1998; Zyngier, 2009). It is also true that, despite boys' relative underperformance in school, later in life women continue to be disadvantaged in many areas[3] and therefore, from a policy perspective, a balance must be found between helping boys achieve their potential and not losing sight of other gender imbalances which favour men (Epstein et al., 1998; Francis & Skelton, 2005; Keddie, 2006).

Aims of our paper

Our aim in this paper is, firstly, to describe recent gender differences, based on data for pupils who sat their GCSEs in 2005, and, secondly, to consider how gender and social background interact to produce or predict these pupils' educational outcomes. Since our focus is not on actual interactions in the classroom, we will not be able to adjudicate firmly on which, if any, of the theories proposed above is most valid. However, as Goldthorpe (2007) reminds us, following Merton (1987), it is necessary first, to 'establish the phenomena' before attempting explanations. Merton's suggestion is based on his making a distinction between description and explanation. First, patterns or regularities in the social world have to be *described*, and these regularities then allow and require *explanation* (Merton, 1987, p. 2). We concentrate on the first step here, providing a conjunctural account, but we will also be able to comment a little on which theoretical explanations are compatible with our findings. Given our interest in how gender and social background act together to produce educational outcomes, we use the configurational method QCA which is particularly well suited to analysing the complexity found in the social world. While using interaction effects in conventional regression models is one way of modelling such complexity, higher-order interaction effects can be difficult to interpret and/or impossible to model due to multicollinearity and too few degrees of freedom. QCA, in comparison, renders these relationships transparent.

Data

We use data provided by Durham University's Centre for Evaluation and Monitoring (CEM). CEM conducts large-scale educational monitoring studies whose main purpose is providing feedback to schools on pupils' performance, including value-added analyses. In addition to performance indicators, background data are collected (for an overview of CEM's work, see Tymms & Coe, 2003). Here, we use Yellis (*Ye*ar *11 I*nformation *S*ystem) data from 2005. During Year 11, pupils take a cognitive ability test (the Yellis test), provide background information and fill out an attitudinal questionnaire. The school later adds GCSE exam results. The cognitive test is designed to measure developed abilities which can predict GCSE performance. We have split the data into two files, constructed to have no missing values on core variables, one containing pupils in non-selective schools (state comprehensive schools, secondary modern schools and independent schools which are not academically selective), N = 10,147, and the other containing pupils in academically selective schools (state grammar schools and academically selective independent schools), N = 1573. The two groups of cases are so different that it would have obscured some findings if we had not separated them.

Given that our chosen method of analysis is crisp set Qualitative Comparative Analysis (csQCA, explained in the next section), the variables employed in the analyses must be dichotomous.[4] We recoded the Yellis test results to create one variable indicating whether or not someone was in the top quartile of the Yellis test distribution, and one indicating whether or not someone was in the top half.[5] Other variables employed are gender (coded 1 = male, 0 = female) and parents' level of education, where, for pupils in non-selective schools, EDU_O_1P = 1 indicates that at least one parent had at least O level qualifications, EDU_O_1P = 0 indicates that neither held O level qualifications, and, for pupils in selective schools, EDU_D_2P = 1 indicates that both parents have degrees and EDU_D_2P = 0 indicates that one or neither has a degree. Between the period of schooling of the parents and their children, O level qualifications have been replaced by GCSEs, but they would have been the qualifications on offer for the parents in our study when they were 16 years old. For the outcome, for non-selective schools, we analysed whether or not someone had obtained at least five GCSEs at A* to C, including English and mathematics and, for selective schools, whether or not someone had obtained at least five GCSEs at A* to B, including English and mathematics.[6] We also include some descriptive analyses of the raw variables.

To address social background, we use the measure for parental education rather than social class. One reason is that much of the theoretical discussion in this area assumes the importance of cultural capital, and education seemed a better proxy for cultural capital than an occupation-based class measure. In addition, the class measure from the Yellis dataset is not in a standard sociological form. However, we replicated some of our analyses using this class measure. The results were very similar.[7]

Results

Descriptive results

Table 1 compares boys' and girls' Yellis test scores and GCSE results. To obtain numerical values, GCSE grades have been coded $A^* = 8$, $A = 7$, etc., down to $U = 0$. In non-selective schools, boys' Yellis test performance is slightly higher. At GCSE, boys in these schools have achieved around one-third of a grade below girls on average, they gain nearly one fewer GCSE at A^* to C, fewer of them achieve the benchmark of at least five A^* to C grade GCSEs, and their performance in English is around half a grade lower. These differences are statistically significant, whereas that in GCSE mathematics performance, where boys have a slightly higher mean score, is not.

Unsurprisingly, in selective schools performance is higher overall. Here, we also see gender differences mostly in the same direction as those in non-selective schools, excepting the Yellis test score. Another difference is that, in the selective schools, girls outperform boys in mathematics as well as in the other areas. The differences are all statistically significant, barring that for the Yellis test score (which is almost significant).

Table 1. Boys' and girls' Yellis and GCSE results.

	Boys	Girls	*p*-Value for difference in means
Non-selective schools			
Mean Yellis test score	54.47	53.14	0.00
Mean average GCSE score	4.89	5.21	0.00
Mean number of A^* to C grades at GCSE	5.61	6.49	0.00
Percentage with at least five A^* to C GCSE grades, including in English and mathematics	56	63	0.00
Percentage with at least five A^* to B GCSE grades, including in English and mathematics	24.6	31.8	0.00
Mean English GCSE score	5.08	5.57	0.00
Mean mathematics GCSE score	5.05	5.01	0.21
N	5001	5146	
Selective schools			
Mean Yellis test score	66.87	68.14	0.06
Mean average GCSE score	6.35	6.88	0.00
Mean number of A^* to C grades at GCSE	8.71	9.35	0.00
Percentage with at least five A^* to C GCSE grades, including in English and mathematics	93	98	0.00
Percentage with at least five A^* to B GCSE grades, including in English and mathematics	71.1	91.3	0.00
Mean English GCSE score	6.4	6.94	0.000
Mean mathematics GCSE score	6.48	6.93	0.000
N	391	1182	

QCA results

Initially, we introduce QCA, though space restricts us to discussing key aspects. Ragin's publications provide greater detail (Ragin, 1987, 2000, 2008). For applications of QCA to topics from the field of sociology of education, see for example Cooper and Glaesser (2008, 2010), Glaesser and Cooper (2011) and Cooper, Glaesser, Gomm, and Hammersley (2012).

Consider the following equation, taken from Mahoney and Goertz (2006):

$$Y = A^*B^*c + A^*C^*D^*E.$$

In Boolean notation, capital letters stand for the presence of a condition, lower case letters for its absence, or logical NOT. The * symbol represents logical AND, the + logical OR. This equation therefore shows two alternative pathways as sufficient for the outcome Y to occur: one is the combination of the presence of A and B with the absence of C, the other is the presence of all of A, C, D, and E. Either pathway is sufficient for the outcome, but neither is necessary, given that the other exists. To capture such causal complexity, Mackie (1974) developed the concept of an INUS condition, taken up by Ragin (1987). An INUS condition is an *i*nsufficient but *n*ecessary part of a condition which is itself *u*nnecessary but *s*ufficient. In this equation, B provides an example of an INUS condition because it is itself insufficient (A and the absence of C are also required), but it is a necessary part of the conjunction of conditions A^*B^*c which is sufficient, but not necessary given $A^*C^*D^*E$ exists.

Sufficiency and necessity involve subsethood relations. If a condition is sufficient for an outcome to occur, the set of cases with the condition will be a subset of the set of cases with the outcome. This relationship is reflected in the Venn diagram to the left of Figure 1. Here, condition A is sufficient for outcome O: whenever A occurs, O will occur. In the real world, relations are usually less than perfect and we are likely to find a situation such as the one represented to the right of Figure 1, where most but not all cases with the condition A obtain the outcome O. This situation is often termed quasi-sufficiency. The proportion of cases with the condition that obtain the outcome can be taken as a measure of the degree of consistency with sufficiency.[8] Usually, values of around 0.8 or above and no less than 0.7 are considered to indicate quasi-sufficiency.

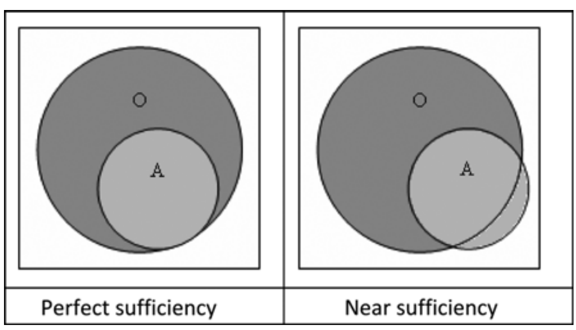

Figure 1. Sufficiency of a condition A for an outcome O.

Venn diagrams may also be used to introduce explanatory 'coverage'. Analogous to 'variance explained' in regression analysis, coverage indicates how important a condition is with respect to predicting and/or explaining the outcome. In Figure 1, we can see that there must be other conditions which also lead to the outcome, since a substantial proportion of the outcome set, O, is not covered by the condition set, A. Numerically, coverage is expressed as the proportion of cases with the outcome that also have the condition.[9]

Necessity also involves subsethood. Here, the outcome must be a subset of the condition, i.e. without the condition, the outcome is not obtained, but not all cases with the condition need obtain the outcome. Consistency with necessity can be calculated in an analogous manner to sufficiency, noting the proportion of the cases with the outcome that have the condition.[10] In this paper, however, we concentrate on sufficient conditions.

Obviously, social scientists are usually interested in more than just one condition predicting some outcome. In regression approaches, the focus is usually on estimating the net effects of independent variables, while controlling for others (Ragin, 2006). In this paper, rather than focusing on net effects, we explore the ways in which social background and gender in combination predict educational outcomes. QCA is well-suited to analysing such conjunctions of conditions and, in addition, to situations where there are several pathways to the outcome, as will become clear.

Non-selective schools

We will now use the CEM data, but initially from non-selective schools only, to explain QCA in greater detail. To conduct a QCA analysis, the data are laid out in a truth table where 1 and 0 are used to indicate, respectively, membership and non-membership of sets (Table 2). The first three columns refer to potentially causal conditions. Here, they are gender, Yellis test result (with YELLIS50 = 1 being those above the median), and whether at least one parent holds at least O level qualifications (coded EDU_O_1P = 1). The next column gives the number of cases for each configuration. For example, there are 1954 girls whose Yellis test score was in the upper half of the distribution and who have at least one parent with O level qualifications. We can think of the rows as types of cases. The number of rows grows exponentially with the number of conditions. Here, we have three conditions generating $2^3 = 8$ rows.

The column headed 5A_STAR_C_EM indicates the outcome, obtaining at least five GCSEs at A* to C, including English and mathematics. The last column gives the degree to which each configuration is consistent with a relation of sufficiency for

Table 2. Truth table with three conditions, non-selective schools.

MALE	YELLIS50	EDU_O_1P	Number	5A_STAR_C_EM	Consistency
0	1	1	1954	1	0.94
0	1	0	282	1	0.87
1	1	1	2075	1	0.86
1	1	0	352	0	0.71
0	0	1	2092	0	0.46
1	0	1	1911	0	0.35
0	0	0	818	0	0.22
1	0	0	663	0	0.18

the outcome, which, as explained earlier, in csQCA is equivalent to the proportion of cases with a particular condition (or conjunction of conditions) obtaining the outcome. As a matter of convention, the rows are ordered in descending order of consistency which means that the order of the rows is, itself, potentially interesting. We can see that the first configuration has a consistency with sufficiency of 0.939, making this a quasi-sufficient configuration of conditions for achieving the outcome.

One aim in QCA is to obtain a summarising solution for conditions which are sufficient for the outcome. This solution is obtained by deciding on a threshold above which conditions are considered to indicate a relation of quasi-sufficiency and then entering the rows complying with this cut-off criterion into a process of Boolean minimisation. For our example, we have set the threshold at 0.8, and the first three rows are entered into the minimisation process.[11] Our choice of threshold is reflected in the 1s and 0s entered in the outcome column, 5A_STAR_ C_EM.

The *non-minimised* solution comprising the three quasi-sufficient configurations is

$$\begin{gathered}\text{male}^*\text{YELLIS50}^*\text{EDU\_O\_1P}+\\ \text{male}^*\text{YELLIS50}^*\text{edu\_o\_1p}+\\ \text{MALE}^*\text{YELLIS50}^*\text{EDU\_O\_1P}.\end{gathered}$$

Using the fs/QCA[12] software (Ragin, Drass, & Davey, 2006), this becomes, via the minimisation process,[13] male*YELLIS50 + YELLIS50*EDU_O_1P. In other words, we have two basic pathways of conjunctions of sufficient conditions associated with the outcome. One combines being in the top half of the Yellis test distribution and being female, the other combines the same range of Yellis scores with having at least one parent with at least O level qualifications.

The fs/QCA software also provides us with the consistency and coverage figures, both for the overall solution and for the individual terms comprising the solution. This output is:

	Raw coverage	Unique coverage	Consistency
male*YELLIS50 +	0.34	0.04	0.93
YELLIS50*EDU_O_1P	0.60	0.23	0.90

solution coverage: 0.64; solution consistency: 0.90.

We need briefly to explain *raw* and *unique* coverage. Whenever a solution contains more than one element linked by logical OR, it is possible to partition the overall coverage to obtain an idea of the contribution of these parts. Unique coverage figures tell us the coverage for each part of the solution which is *only* covered by that part, not overlapped by any other part of the solution, whereas raw coverage figures give the coverage of all of this part, including the overlap. This is illustrated in an idealised[14] form in Figure 2, where for the configuration male∗YELLIS50 in the Venn diagram, the second darkest area corresponds to the unique coverage of this configuration, and the second darkest and the darkest together correspond to its raw coverage.

If the unique coverage for a term in the solution is lower than its raw coverage, this indicates that there is some overlap between cases' membership in the terms in the solution. A large degree of overlap, of the sort we see in Figure 2, is not

Figure 2. Venn diagram, more than one condition.

empirically unusual. Here, many cases belonging to the set of higher-ability girls also belong to the set of higher-ability children of parents with O level qualifications. The configuration male*YELLIS50*EDU_O_1P, which is, algebraically, a subset of both male*YELLIS50 and YELLIS50*EDU_O_1P, has, in this dataset, many members. One element in our solution, male*YELLIS50, has a fairly low unique coverage. This indicates that the contribution to overall coverage by cases that belong just to this set but not the other one, YELLIS50*EDU_O_1P, is low. Most, but not all, of the higher-ability girls obtaining the outcome have parents with O level qualifications.

Having introduced the key elements of QCA, we can now refine our analysis by adding the factor YELLIS25, indicating the set of people whose performance on the Yellis test was in the top quartile, in order to get a more detailed picture of the role of ability. In the resulting truth table, Table 3, we have added the first column, numbering each row, to facilitate reference to configurations.[15]

We analyse this truth table using two different thresholds for consistency, one of 0.85 and one of 0.75. Employing different levels of consistency can provide additional insights concerning the relationships between configurations of conditions and the achieving of the outcome, as demonstrated by Cooper (2005). These two resulting solutions for quasi-sufficiency are[16]:

0.85 threshold:

	Raw coverage	Unique coverage	Consistency
YELLIS25 +	0.32	0.18	0.96
male*YELLIS50*EDU_O_1P	0.30	0.16	0.94

solution coverage: 0.48; solution consistency: 0.94.

0.75 threshold:

	Raw coverage	Unique coverage	Consistency
YELLIS25 +	0.32	0.02	0.96
male*YELLIS50+	0.34	0.03	0.93
YELLIS50*EDU_O_1P	0.60	0.15	0.90

solution coverage: 0.66; solution consistency: 0.90.

Table 3. Truth table, four factors, non-selective schools.

Row no.	MALE	YELLIS25	YELLIS50	EDU_O_1P	Number	5A_STAR_C_EM	Consistency	Yellis score (mean)
1	0	1	1	1	868	1	0.98	71.6
2	0	1	1	0	79	1	0.96	70.5
3	1	1	1	1	960	1	0.95	72.3
4	0	0	1	1	1086	1	0.91	60.6
5	1	1	1	0	117	1	0.89	70.9
6	0	0	1	0	203	1/0	0.83	59.9
7	1	0	1	1	1115	1/0	0.79	60.6
8	1	0	1	0	235	0	0.63	59.9
9	0	0	0	1	2092	0	0.46	44.5
10	1	0	0	1	1911	0	0.35	44.5
11	0	0	0	0	818	0	0.22	42.4
12	1	0	0	0	663	0	0.18	42.0

At both threshold levels, being in the Yellis test's top quartile provides one pathway to the outcome of gaining at least five A* to C grades at GCSE. The other pathways at the 0.75 consistency level include at least being above the median on this test, combined with either being female or with having at least one parent with O level qualifications. At the more demanding level of 0.85, these three factors, for students not in the top quartile on the test, must be jointly present to predict the outcome.

For both genders then, being in the top quartile for ability is a quasi-sufficient condition for obtaining at least five A* to C GCSEs. This is not surprising given that the Yellis test was designed to predict exam success. This makes it especially interesting, however, to focus on ways in which the ascriptive factors of gender and parental education combine with lower levels of test score to predict the outcome. We do find that having ability above the median is important.[17] For girls, but not boys, this is a quasi-sufficient condition for obtaining the outcome at the 0.75 consistency level. Boys with ability scores above the median, if they are not in the top quartile, need, in addition, at least one parent with at least O level qualifications as indicated by the term YELLIS50*EDU_O_1P.

It is worth inspecting the truth table in more detail. As mentioned, the rows are configurations of factors, effectively types of cases. Given an interest in gender differences with regard to the role of social background and educational outcomes, it is useful to undertake pairwise comparisons of selected rows. Comparing rows 4 and 6, we can see that between girls of similar ability, i.e. those in the second quartile of the test distribution, the proportion of those whose parents are more highly qualified obtaining the outcome is 8 percentage points higher than those whose parents do not hold O level qualifications. The relevant comparison for boys is between rows 7 and 8. Boys' average attainment is lower than girls', and also more strongly related to parental qualifications. The difference between boys with similar ability with and without parental O levels is 16.5 percentage points. It is also interesting to note that the difference for each gender is considerably smaller at the highest ability level (rows 1 and 2 versus 3 and 5), though a ceiling effect may operate here.[18]

Selective schools

We now turn to academically selective schools. To begin with, it is worth noting that, in our sample, the number of girls in selective schools is far larger than that of boys. There are a number of possible reasons for this. It may be partly due to the greater take-up of the CEM monitoring system by girls-only selective schools in comparison with selective boys-only or selective mixed schools. It may also reflect a move away from single-sex schooling for boys in the private sector, which is where most selective schools are now to be found. It may also partly reflect the way our dataset has been constructed by combining CEM Centre data for different age ranges. The crucial question is whether there is likely to be any systematic bias reflected in our results. Insofar as we discuss the configurations one by one, or allow them to go forward into a minimised solution on the basis of whether they individually pass a threshold for quasi-sufficiency, the key point regarding potential sample bias for our purposes relates to each configuration treated as a type of case. Have we, that is, a sample of each type (i.e. configuration) that is unbiased? As a partial check, we can look at the mean Yellis test score for each configuration as one indicator of possible bias. (For the whole dataset from which we take our cases, its mean is 53.8 and its SD is 13.3 for pupils in non-selective schools, for pupils in selective schools the mean is 67.8 and SD is 10.4.) We have added a column to the truth tables (Tables 3 and 4) showing the mean Yellis score for each row. Various pair-wise comparisons (just letting one factor vary) of these means do not suggest that we have any major bias to worry about here. Look, for example, at rows 1 versus 5, differing only by gender (Table 4).[19]

As we have seen in the descriptive analyses above (Table 1), pupils in selective schools perform better overall. Their parents are also more highly educated, on average. For these reasons, we use slightly different measures in our analysis of pupils in selective schools. The outcome measure here is obtaining at least five A* to B GCSEs (5A_STAR_B_EM). The measure for parental education is whether both parents have degrees, with EDU_D_2P = 1 for 'both parents have degrees' and EDU_D_2P = 0 'one or neither has a degree'. Table 4 provides the truth table.

The solutions for three different consistency thresholds are:

0.95 threshold:

	Raw coverage	Unique coverage	Consistency
male*YELLIS25	0.54	0.54	0.98

solution coverage: 0.54; solution consistency: 0.98.

0.9 threshold:

	Raw coverage	Unique coverage	Consistency
male*YELLIS25 +	0.54	0.29	0.98
male*YELLIS50*EDU_D_2P	0.33	0.07	0.97

solution coverage: 0.61; solution consistency: 0.97.

0.8 threshold:

	Raw coverage	Unique coverage	Consistency
male*YELLIS50+	0.74	0.13	0.95
YELLIS25 +	0.69	0.10	0.95
YELLIS50*EDU_D_2P	0.39	0.02	0.95

solution coverage: 0.90; solution consistency: 0.93.

Again, we find that a top quartile Yellis score constitutes a pathway to the outcome, but only at the lowest consistency level. At higher levels, there is no quasi-sufficient condition or conjunction of conditions which includes boys. At the 0.8 consistency level, in addition to the top quartile ability pathway, there is also the pathway of having two parents with degrees for boys and girls, but only if they have ability above the median (though we should note that unique coverage, at 0.02, is very small for this pathway). We also find a pathway comprising being a girl conjoined with having ability above the median. One part of the solution for pupils in non-selective schools at the 0.85 consistency threshold was being a girl

Table 4. Truth table, selective schools.

Row no.	MALE	YELLIS25	YELLIS50	EDU_D_2P	Number	5A_STAR_B_EM	Consistency	Yellis score (mean)
1	0	1	1	1	347		0.99	75.2
2	0	1	1	0	401		0.97	72.9
3	0	0	1	1	109		0.90	61.4
4	1	1	1	0	153		0.87	75.1
5	1	1	1	1	73		0.86	76.0
6	0	0	1	0	204		0.86	61.5
7	1	0	1	1	24		0.83	62.8
8	0	0	0	1	28		0.64	48.6
9	1	0	1	0	66		0.64	60.5
10	0	0	0	0	93		0.58	49.8
11	1	0	0	0	58		0.28	47.9
12	1	0	0	1	17		0.24	48.9

with ability above the median with at least one parent having at least O level qualifications, male*YELLIS50*EDU_O_1. The comparable pathway here, at the 0.9 level, is male*YELLIS50*EDU_D_2P, i.e. girls with ability above the median and whose parents both hold degrees. We can also repeat the pairwise comparison we did for non-selective schools. The relevant rows here are rows 3 and 6 versus 7 and 9. The difference in consistency between girls in the second quartile of the test distribution with and without parents with degrees is around 5 percentage points, whereas the difference for otherwise comparable boys is almost 20 points.

A closer look at specific configurations confirms that the findings parallel those from the non-selective schools, both in that girls attain more highly than boys of similar ability and in that boys are more disadvantaged by lack of parental qualifications. Here, too, the difference in outcome associated with parental education for pupils in the top quartile of the test is negligible. This corresponds, of course, to the findings obtained through the minimisation process.

Conclusion

We have shown that both gender and social background, represented by the proxy of parental educational capital, continue to play a part in predicting educational attainment but, more specifically, have explored the interaction of these two factors in predicting educational outcomes. Our conjunctural approach, as well as showing how outcomes vary by type of pupil, has also demonstrated that more than one pathway is quasi-sufficient for our chosen outcome.

The Yellis test is designed specifically to predict GCSE performance. Therefore, if gender and social background were not important at all, we should not find any systematic differences in GCSE attainment between groups differentiated by these ascriptive factors given the same level of performance on the Yellis test. This is largely true for the highest performers on the test: having top quartile ability constitutes a quasi-sufficient condition in most of the solutions we obtained, and neither being male or female nor being from a particular familial educational background have to be combined with it. However, a lower, but still above average, level of ability is not sufficient on its own for gaining at least five A* to C GCSEs for pupils in non-selective schools, or five A* to B GCSEs for pupils in selective schools. Since the proportion of pupils achieving at this level is above 50% overall, if the test were a perfect predictor of GCSE performance and no countervailing ascriptive factors intervened, then being in the top half might be expected to be a single sufficient condition for the outcome. So analysing the conditions which, when combined with having ability above the median, are quasi-sufficient is a fruitful way of gaining insights into the possible effects of ascriptive factors. Both the pairwise comparisons of configurations differing only by gender and the QCA-derived Boolean solutions suggest that boys suffer more from lack of cultural capital, as indicated by parental education, with regard to educational attainment at GCSE, a finding compatible with what some authors have described (Buchmann et al., 2008; Entwisle et al., 2007). We have been able, if not to confirm conclusively that a particular mechanism is operating, then at least to provide evidence which is in line with the theory claiming that the class/gender interaction is brought about by the greater compatibility both of girls' behaviour and of middle-class values and culture with school culture (Entwisle et al., 2007). Given we have found similar patterns of results in academically selective and non-selective schools, it seems plausible that the mechanisms producing the gender and social background differences are not associated with type of school. However, as pointed out in the introduction, further research is needed in order to get more insight into the relevant generative mechanisms producing these patterns.

Acknowledgement

This work was supported by an Economic and Social Research Council (ESRC) research fellowship (RES-063-27-0240) awarded to JG.

Notes

1. Throughout the paper, we use the term 'social background' to refer to the complex combination of factors characterising the home background, including social class and parental education. While much of the literature on social background and educational outcomes focuses on social class measures, we have used parental education as our social background indicator, for reasons we explain in the section on data.
2. It has been suggested (Vester, 2006) that, rather than competing, the two theories (Bourdieu and rational choice) complement each other. Within this perspective, primary effects are understood as resulting from class-based cultural differences.
3. Keddie (2006) points out that women, for example, continue to be paid lower salaries, have increasing and unprecedented levels of welfare dependency, and fewer career opportunities.
4. While dichotomisation may result in loss of information, this is not a major problem here because most of our variables are either dichotomous or lend themselves easily to dichotomisation. This is not as obviously the case for the Yellis test, which is why we make use of dummy variables for this measure.
5. Of course, cases in the top quartile of the distribution are also contained in the top half. Using these indicators makes it possible to distinguish between the first and second quartiles, and also between the top and the bottom half. We use the top quartile because it roughly maps on to the proportion of young people who once would have obtained O levels in the tripartite system. Given educational expansion, the proportion of young people obtaining five A* to C GCSE grades has increased and we have therefore added the second quartile in order to explore how well the ability measure predicts qualifications obtained in these new circumstances.
6. GCSE pass marks range from A* to G, with A* the highest grade. The mark 'U' means unclassified, or a fail. The number of marks in the A∗ to C range is often used as a benchmark of high achievement, both for the pupils and schools.
7. We should also point out the summarising nature of these factors. Parental education and gender are not, in themselves, the mechanisms that produce outcomes.
8. This is true in the crisp context, where a case is either completely in or completely out of a set. With fuzzy sets, cases can have partial membership of sets, considerably complicating the measurement of consistency. See Ragin (2000, 2005, 2008) and also Cooper (2005).
9. Again, this applies in the crisp context.
10. Again, only in the crisp context.
11. We have also taken account of the large gap in consistency between rows 3 and 4. Readers concerned that such threshold-setting seems arbitrary should bear in mind that much decision-making in the social sciences involves the researcher's judgement: consider the choice of a 5% level in significance testing.
12. The 'fs' stands for fuzzy set. The software implements both crisp and fuzzy set QCA.
13. The process works as follows. Consider the first two rows, 011 and 010. Given the threshold for consistency we have chosen, the third condition, EDU_O_1P, makes no relevant difference. These two terms can therefore be combined to produce 01–, where the dash indicates the third condition makes no relevant difference. 01– is, of course, male*YELLIS50, the first part of our minimised solution. The two original terms are subsets of male*YELLIS50.

14. This diagram is not precisely to scale.
15. There are some differences in the number of boys and girls for various pairwise comparisons in this table. Rows 1 and 3 (i.e. the configurations 0111 and 1111) provide an example, having 868 girls but 960 boys. In order to check whether we are likely to have any systematic bias by ability when making such pairwise comparisons by gender, we have added a column giving mean Yellis ability scores. A comparison of relevant pairs suggests we have no major problem here.
16. Using a higher threshold for sufficiency in a crisp set analysis reduces the coverage of the overall solution since fewer rows of the truth table enter the solution.
17. It is not, however, a quasi-necessary condition. A separate test for the quasi-necessity of YELLIS50 reports a consistency of 0.682.
18. Given the difference in performance of boys and girls in English and mathematics, it seemed worthwhile investigating attainment in both subjects separately. Therefore, we also undertook two parallel analyses using attainment of at least 'C' in English and mathematics as outcomes. The patterns of results looked very similar to the ones presented so far for gaining at least five A* to C GCSEs. Both being a girl and having a parent with at least O level was a quasi-sufficient condition for obtaining the outcome, and girls achieved more highly independently of their parents' level of education.
19. However, it is also the case that the relative numbers in each row of the truth table will affect the consistency and coverage figures reported for any combination of the initial configurations that arise from the minimisation process, including those for the three overall solutions for selective schools we report later. To explore the likely effect of the gender imbalance on these results, we have analysed a reweighted truth table where we have constructed equal numbers of boys and girls for each pair of configurations that differ only by gender (such as rows 1 and 2 of Table 4). The terms appearing in the three Boolean solutions for sufficiency we report later are, as expected, unchanged by this reweighting. In addition, the consistencies for the three solutions we report later are hardly affected. The overall coverage figures are lowered in the case of the solutions using thresholds of 0.95 and 0.9 reported later but they are almost unchanged for the 0.8 solution.

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